

and the storm centre invariably passes to the south of that spot. It was but natural, therefore, to suppose that the storm came from the W. or W.S.W. of the Leeuwin, and the winter and summer disturbances have been regarded as two distinct varieties. Within the last two years, however, circumstances have been noted which seem to show that there is no real distinction between the two. In July, 1904, I first directed public attention to the fact that certain of our winter storms could be distinctly traced down the west coast, affecting N.W. districts first, and then travelling in a S. or S.E. direction. I have gone somewhat fully into this matter in my "notes" on the climate of Western Australia for the month of July, 1904, and when once the fact has been indicated it becomes easy to find numbers of cases when winter storms can be seen to have a considerable southerly component of motion. Only a few days ago, for instance, a disturbance struck the N.W. coast in about lat. 20°, and travelled in a S.E. direction across the State, giving rain just along the fringe of our most eastern settlements, probably much heavier in the interior desert, and causing a heavy downpour in South Australia from the centre to the south coast. Again on May 20 a disturbance approached the N.W. cape, causing rain there, next day being definitely located in the ocean a little to the S.W. of Perth, and certainly considerably north of Cape Leeuwin, then continued to travel down the coast, rounded the Leeuwin, and behaved thenceforward just like any other winter disturbance.

There is, therefore, plenty of evidence that "lows" do travel down the Indian Ocean, even in the winter months, in a southerly or S.E. direction towards Cape Leeuwin, and probably all, or nearly all, of our storms come in this way. If this be so, the charts on p. 111 are misleading. Our rain certainly does not come mainly with a S.W. or S. wind, nor is there (probably) any stationary "high" as marked. Instead there is a series of "highs" moving towards our west coast, broken up by a series of "lows," which pass between and make for the extreme S.W. corner of Australia. The weather which we specially desire to predict comes with these "lows." Several things follow from this. One is that the Amsterdam and St. Paul Islands are far too much to the southward to be of any use to us for practical forecasting purposes, though a few years' records from there would be exceedingly valuable. Another is that Dr. Lockyer's theory about the S.E. trades and S.W. monsoon requires some modification, though it is very probable that the Indian and Australian weathers are inter-dependent and require to be studied together. A third is that Sir John Eliot's proposal for an Empire study of meteorology ought to be acted upon as soon as possible, and all our observations coordinated to some definite purpose. A fourth is that, failing this, Australian meteorologists ought to make every effort to bring about the establishment of a central Australian bureau for the study of scientific meteorology, as recommended at the recent conference held in Adelaide.

W. ERNEST COOKE.

Perth Observatory, Western Australia, July 3.

DUTY-FREE ALCOHOL.

HOW far the trade in synthetic colours and fine chemicals has been lost to the country through the heavy customs restrictions placed upon the use of alcohol is a question which has been agitating manufacturers for many years past. On the one hand, we are told that the entire chemical trade has been diverted from our shores because of the high cost of alcohol; on the other, that the alcohol question has very little to do with the matter. After the agitation for the use of duty-free alcohol had been going on for some years, and owing to its increasing intensity and to the pertinacity of a few, the Government in the autumn of last year appointed a departmental committee to take evidence in order to find out whether the high duty on alcohol really was the factor which caused the practical extinction of the aniline dye industry and accounted for our inability to found an industry in fine synthetical products. The

committee commenced to take evidence on November 8, 1904, and finished on February 17 of this year.

More is heard about the loss of the synthetic colour trade to the country than about the loss of any other industry, or about the failure to establish new industries which flourish on Continental or American soil. The loss of the coal-tar colour industry is variously ascribed to incompetence on the part of our manufacturers and their failure to realise the importance of employing—and paying for—highly trained scientific chemists, to our patent laws, to trade protection abroad, and to the excessive duty charged upon alcohol in this country. The report with which we are at present dealing has to do with the last question—duty-free alcohol. A careful perusal of the questions to and the answers of the witnesses before the commission, which included most of the well-known names in the coal-tar colour industry in this country, does not convince one that this special industry has been lost to the country owing to the high cost of alcohol.

The amount of alcohol used at the present day for preparing the dyes is not very large. At one time many of the dyes were sold as alcoholic extracts, and alcohol was somewhat largely used in the preparation of the products. Since the introduction of the azo dyes, however, alcohol is not nearly so largely employed as formerly. There are, indeed, certain dyes in which the methyl or ethyl radical is introduced during the process of manufacture, and these require the employment of methyl or ethyl alcohol in their preparation, and, of course, in this case the alcohol cannot be recovered; for example, the dyes in which dimethyl aniline is the starting product. British manufacturers who desire to make these colours import all the dimethyl or diethyl aniline from abroad. It came out, however, in the evidence that one large aniline dye company which desired to manufacture dimethyl aniline obtained Government sanction to employ methyl alcohol mixed with one-twentieth of 1 per cent. of mineral naphtha—"a condition which the company stated would suit their purposes." Although from the evidence before the commission it appeared that there was "a substantial profit to be made upon the manufacture of dimethyl aniline," for some reason or other it was never manufactured.

Reviewing the evidence of the different persons connected with the coal-tar dye industry, one is brought to the conclusion that, although the high price of alcohol has militated against the success of the industry, yet there are other even more potent factors which have prevented the industry being successful. Manufacturers, with a few isolated exceptions, have not even been successful in meeting Continental competition in dyes which do not require the use of alcohol. Prof. Green probably came very close to the truth when he said, in reply to a question as to what he considered the cause of the decline of the coal-tar colour industry:—

"They (the manufacturers) did not realise the great importance of research; the great importance of theory. They expected to see an immediate result from experiments, and if they did not get an immediate result they considered that they were wasting their money. They did not employ a sufficient number of research chemists, and they did not pay those research chemists they had to encourage them to remain. . . . There may be other contributory causes, such as the patent laws and this question of the spirit."

There seems to be a strong consensus of opinion that in the xylonite and gunpowder manufactory leave to use pure alcohol is much to be desired. Xylonite when made with methylated spirit is inclined to darken, and there is thus a difficulty in

making materials which should be white or ivory coloured.

In the gunpowder manufactory, if pure alcohol were used to dehydrate the material the dangerous drying process by heat could be done away with, because the material moistened with alcohol can be directly placed in the mixers containing acetone, &c., the moistness due to alcohol not interfering with the process of manufacture, whereas that due to water is harmful. For making so-called "condensed" powders which are totally dissolved in the solvent the action of methylated spirit is objectionable; as one of the witnesses stated, "you cannot control the surface of the grain with a methylated-ether mixture in the same way that you can with a pure alcohol-ether." To a large extent the lack of initiative on the part of British powder manufacturers may be indirectly attributed to the high cost of alcohol. Some lacquer manufacturers and users of lacquers state that lacquers made from pure alcohol are very much superior to those made from methylated spirit. Mr. Bagley, the witness from Messrs. Samuel Heath and Sons, the largest brass-founders in the world, stated that, although they are easily able to compete with Continental manufacturers so far as their brass ware is concerned, their goods are often not acceptable because of the want of durability and finish of the lacquering. The lacquer costs something about 4s. per gallon, but they can, by paying 32s., obtain a lacquer made with absolute alcohol, and this is as good as the best foreign lacquer. The witness said he was ashamed to have to confess that they could not obtain the fine finish which the Germans produced, and, as regards the French importers, they absolutely refused to take lacquered articles, but bought them unlacquered and finished them themselves. This witness was of the opinion that the foreign lacquers were made with pure alcohol, but it was subsequently pointed out by the chairman that even abroad it was denatured. On the other hand, Mr. Gardiner, the manager of the firm of Messrs. A. Lambley and Sons, said that they not only could make lacquers as good as Continental manufacturers, but that they had a large export trade and had no difficulty in meeting Continental competition; they very rarely used pure alcohol for making lacquers.

From the extremely contradictory evidence of these two witnesses it would appear that it is more a matter of method or knack in the manufacture than of methylated or pure alcohol which determines the quality of the lacquers.

There seems very little doubt but that the manufacture of fine chemicals and synthetic perfumes is considerably interfered with owing to the British manufacturer not being able to use duty-free alcohol. When methylated alcohol is employed for crystallising the substances there is invariably a peculiar and disagreeable odour attending the finished product. But if the manufacturer, in order to get over this difficulty, employs duty-paid absolute alcohol, the increased cost of manufacture is prohibitive. It was stated in evidence, for example, that with regard to the manufacture of phenacetin "the duty on the spirit would come to 140l. on 100l. worth of the article as imported."

Chloral hydrate is another substance which cannot profitably be made in this country. In the manufacture of ether from methylated spirit Mr. David Howard stated that "if we might have pure methyl alcohol and pure ethyl alcohol, it would be a beautiful thing to make ether of. But the result of the ketones and other bodies in it is that the sulphuric acid gets in a most horrible mess, and we get abominable compounds which I have never been able to excite the

interest of any chemist in yet; but they are a very great disadvantage."

Those connected with the motor-car industry and the use of alcohol for motor engines in place of petrol seemed to consider that very much better results can be obtained with pure alcohol than with methylated spirit. A perusal of the evidence leads to the conclusion that further experimenting in this direction would be advisable. One is certainly inclined to the opinion that the presence of bases would be harmful, as these would probably on combustion be converted into products which would corrode the metal work. Of course, if alcohol is to be employed for motor purposes it would of necessity require to be denatured, because it would then be sold in large and small quantities at every little oil-shop in the kingdom. If motor-engineers wish to build alcohol engines they will have to experiment with all sorts of denaturants, and, doubtless, the excise authorities would aid them in their endeavours.

In reading through the report one is struck by the repeated reference which is made to the relative cost of pure *duty-free* alcohol in the United Kingdom and in Germany; British manufacturers do not seem able to compete in the manufacture of alcohol with their German rivals even when working under equal conditions. Further, it is a well-known fact amongst chemists that it is practically impossible to get really good absolute alcohol of British manufacture. It is a remarkable fact that traces of impurities which one can barely find by analysis interfere very much with the smooth working of reactions in which alcohol is employed. This fact came out again and again in the evidence of witnesses before the committee. Those on the committee who were there to look after the interests of the excise endeavoured with great skill to shake the evidence on this point, explaining that if the quantity of an impurity was only a fraction of a per cent., it surely could not possibly cause all the mischief attributed to it. The invariable reply was, the product when made with absolute alcohol has such and such properties, but it is either impossible or a matter of extreme difficulty to obtain the same results with methylated spirit.

On the other hand, in a good many cases it appeared that sufficient experimental work had not been tried. Methylated spirit had been condemned for manufacturing this or that article, but little or no attempt seemed to have been made to try spirit denatured in other ways or to try the use of other solvents. By the Act of 1902 manufacturers were allowed to suggest other means of denaturing the alcohol, and in some cases at least the excise authorities had been very willing to aid them in their efforts. As a matter of fact, in manufacturing operations in Germany it is rare for absolute alcohol to be employed, the alcohol generally being denatured in a way which suits the particular manufacturer. Of course, where the use of pure alcohol is absolutely necessary the German has a much lower excise duty to compete with than the British manufacturer. That excise restrictions, the high duty on alcohol, and a considerable amount of red tape have, in some cases, made the manufacture of certain products—so as to compete with the foreign manufacturer—almost an impossibility there can be no doubt. But why that should hinder British manufacturers who manufacture products in which alcohol is not employed it is not easy to see.

If instead of calling in an outside "expert" (?) when an emergency arises the manufacturers were to employ a certain number of well-trained chemists, men who, after being on the staff for a short time, should be far and away superior to outside experts, there is but little doubt that fewer emergencies could

arise and that a progressive and ever-improving concern would be the result. There was a great deal in what Dr. Nichols said in his presidential address to the Society of Chemical Industry—the quotation is from memory—"Never put up duplicate plant; no plant is so perfect that it cannot be improved; after a plant has been in use a short time certain points in which it may be improved are sure to be discovered."

So if we are to compete with foreign competition no process should be worked year after year by rule of thumb, otherwise manufacturers will find their product being pushed out of the market by a similar but improved product in which the brain has been the motive power for the thumb.

It is very much to be hoped that now that the matter has been thoroughly threshed out the Government will step in and—while safeguarding its own interests and the sobriety of the workers—it will aid manufacturers by all means in its power by enabling them to use a class of alcohol which will be suitable to their special needs.

F. MOLLWO PERKIN.

THE GEOLOGY OF SOUTH AFRICA.¹

TOWARDS the end of last century it appeared as if England had lost her well earned supremacy in geological research in Africa. In Germany, elaborate treatises dealing sometimes with her own African colonies exclusively, and sometimes with that of neighbouring British territory, monthly and almost weekly appeared. French geologists, too, produced essay after essay on their African colonies and possessions. Meanwhile, England was apparently content to lag behind.

It is fitting that the visit of the British Association to one of our most famous and most remote African colonies this year should witness the publication of two geological works, of the highest scientific standing, written by our own countrymen. Early this year, the comprehensive treatise by Mr. A. W. Rogers on the geology of Cape Colony made its appearance. Now, a few months later, we have presented to us the philosophic *résumé* of the geology of South Africa as a whole by Messrs. Hatch and Corstorphine.

Both volumes supply a long-felt want. In their method and conciseness both are equally British.

In a work treating with the richly metalliferous regions of the Transvaal it might have been expected that questions of economic interest would occupy many pages. It is an agreeable surprise to find that this is not the case. On the contrary, the geology of South Africa is here described in a thoroughly scientific manner, clearly and concisely worded. All essential details are brought within a compass of 312 pages of text.

In the opening chapter, on the history of research, ¹ "The Geology of South Africa." By F. H. Hatch and G. S. Corstorphine. Pp. xiv+336. (London: Macmillan and Co., Ltd., 1905) Price 21s. net.

ample recognition is given to A. G. Bain, the father of South African geology, and also to Stow. More recent workers cannot complain that their investigations have been neglected.

The book is divided into five parts. Part i. deals with the pre-Karoo rocks, in which those of southern Cape Colony are described in section i., and those of northern Cape Colony, the Transvaal, &c., in section ii. This separation into sections becomes necessary owing to the want of similarity in the succession of the pre-Cape rocks in the two regions.

The authors naturally give somewhat more space to the sequence in the Transvaal, more especially to a description of the upper division of the Witwatersrand system, which includes the famous "Banket." It is interesting to find that the stratigraphical position and age of this well known deposit remain unsolved, except that the authors consider the age to be vastly newer than the Archæan rocks and greatly older than the Table Mountain Sandstone.

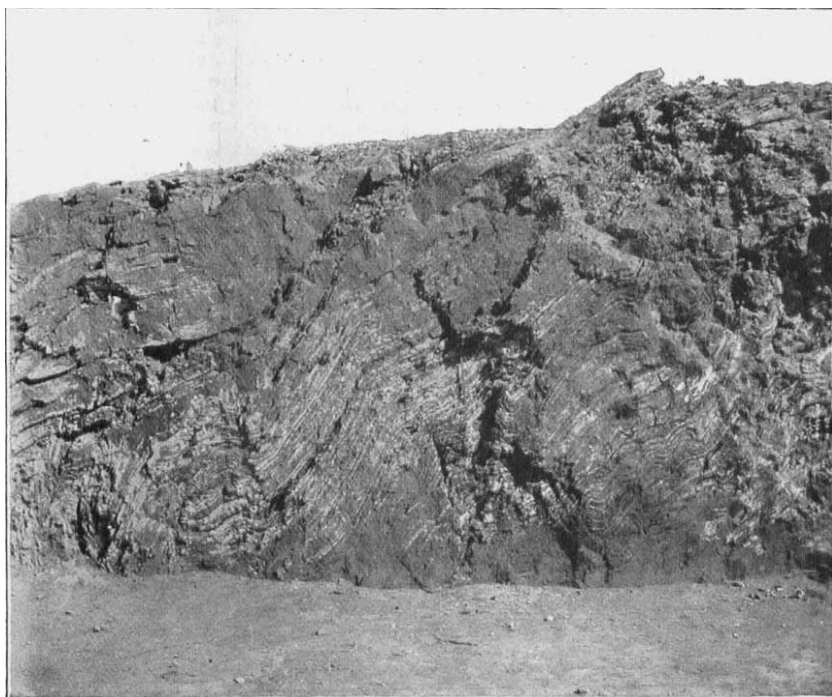


FIG. 1.—Contorted Band, Hospital Hill Slate, Show Yard, Johannesburg. From "The Geology of South Africa," by F. H. Hatch and G. S. Corstorphine.

The complicated nature of the stratigraphy of South Africa, other than that of the peninsula, will be gathered from the following tables:—

North of Cape Colony	Transvaal
Dwyka Conglomerate	Dwyka Conglomerate
Unconformity	Unconformity
Matsap Series	Waterberg Series
Unconformity	Unconformity
Griqua Town,	Pretoria Series
Campbell Rand and Keis	Dolomite and Black Reef
Series	Series
Unconformity	Unconformity
Volcanic Series	Ventersdorp Series
Unconformity	Unconformity
	Witwatersrand Series
	Unconformity
	Swaziland Series
Namaqualand Series	

This table opens up a vista of infinite possibilities.

The Karroo rocks are adequately dealt with in part ii., but in this and elsewhere Rhodesia,